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Prof. Ervin Rodin

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Center for Optimization and Semantic Control
Department of Systems Science and Mathematics
Campus Box 1040, Washington University
One Brookings Drive
St Louis, MO 63130-4899

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13. ABSTRACT *(Maximum 200 words)*

The reason for submitting a single final report for two projects is that the graduate and undergraduate students who were supported by the second of these projects, actually worked on the subject matter of the first one. This project has been an ongoing one, in collaboration with the personnel from HQ/AMC/XPY at Scott AFB. The various joint projects undertaken are presented and discussed at frequent periodic meeting between the personnel of HQ/AMC/XPY and members of the Center for Optimization and Semantic Control at Washington University.

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FINAL PROJECT REPORT

Submitted to
Air Force Office of Scientific Research
Building 410, Bolling AFB, DC 20332

By

Ervin Y. Rodin, P.I.
Professor and Director

Center for Optimization and Semantic Control
Department of Systems Science and Mathematics
Campus Box 1040, Washington University
One Brookings Drive
St. Louis, MO 63130-4899

In connection with

Grant AFOSR F49620-96-1-0151

ARTIFICIAL INTELLIGENCE METHODOLOGIES IN AIR TRANSPORTATION NETWORK ROUTING AND SCHEDULING

AND

Grant AFOSR F49620-96-1-0218

GRADUATE AND UNDERGRADUATE STUDIES IN OPTIMIZING AIR TRANSPORT SCHEDULING AND ROUTING

April 14, 2000

1. INRODUCTION

This is a joint Final Report on the two projects:

ARTIFICIAL INTELLIGENCE METHODOLOGIES IN AIR TRANSPORTATION NETWORK ROUTING AND SCHEDULING,

And on

GRADUATE AND UNDERGRADUATE STUDIES IN OPTIMIZING AIR TRANSPORT SCHEDULING AND ROUTING

The reason for submitting a single final report for two projects is that the graduate and undergraduate students who were supported by the second of these projects, actually worked on the subject matter of the first one.

2. OBJECTIVES.

To support faculty, as well as graduate and undergraduate students, to develop improved methodologies for the scheduling and routing of military transport aircraft; and to do so in collaboration with personnel from Flight XPY at the USAF Air Mobility Command, Scott AFB, IL.

3. STATUS OF EFFORT.

This project has been an ongoing one, in collaboration with the personnel from HQ/AMC/XPY at Scott AFB. The various joint projects undertaken are presented and discussed at frequent periodic meeting between the personnel of HQ/AMC/XPY and members of the Center for Optimization and Semantic Control at Washington University. Reports of these discussions are regularly provided to AFOSR. To illustrate the type of work and results achieved, we are attaching to this report the copies of 2 projects, consisting of both their presentation and of their paper versions:

1. **Simulation of Military Airfields**
2. **Implementation of NRMO to Study the Airlift Problem at AMC**

3. ACCOMPLISHMENTS/NEW FINDINGS

Our principal accomplishments are embodied in doctoral dissertations and in published papers. Copies of all of these items are sent to the AFOSR as soon as they become available. In particular, we presented in this fashion three doctoral dissertations:

1. **Meusey, M. K.: A Semantic Control Approach To Evasive Maneuver Selection**
2. **Rink, K. A.: Adaptation of Shortest Path Algorithms to Mobility Problems**
3. **Chen, Y. J.: A New Compiler-Compiler for Resource Scheduling Problems**

4. PERSONNEL ASSOCIATED WITH THIS RESEARCH (during various periods)

Faculty:

Professors Ervin Y. Rodin (PI)
S. Massoud Amin
Vaidyanathan Sundarapandian

Students:

Travis Cusick	Kathy Rink
Greg Grindey	Brian Russina
Eugene Day	Yenming Chen
Sanghyun Kim	Ilker Tunay
Zoran Nenadic	Xinqiang Qi
Andrea Serrani	Christine Stewart
Brandy Ruthsatz	Christiana Russ

Note: While each of the students above participated and contributed to the tasks of these grants, not all of them were supported. Several of them have been working on these projects as purely academic tasks.

5. PUBLICATIONS

Note: For all of the publications listed below:
Principal Author is the P.I., Ervin Y. Rodin

- "Routing Airlift Aircraft By The Double Sweep Algorithm", (with Rink et. al.), Mathematical and Computer Modelling 30, pages 133-147, 1999
- "Neural Network Augmented Anti-skid Controller for Transport Aircraft," (with Tunay and Amin) ,Proceedings of the 37th AIAA Aerospace Sciences Meeting and Exhibit, paper # AIAA 99-0260, 9 pp., 1999
- "Simulation of Military Airfields," (with Cusick, et. al.), paper #AIAA-98-4822, Proc. of 7th AIAA/USAF/ NASA/ISSMO Symp. on Multidisciplinary Analysis and Optimization, St. Louis, MO, 1998

- "Object Oriented Modeling of the Strategic Brigade Airdrop Operation," (with Grindey, et. al.), paper #AIAA-98-4881, Proc. of 7th AIAA/USAF/NASA/ISSMO Symp. on Multidisciplinary Analysis and Optimization, St. Louis, MO, 1998
- "Implementation of NRMO to Study the Airlift Problem at Air Mobility Command," (with Rink, et. al.), paper #AIAA-98-4821, Proc. of 7th AIAA/USAF/NASA/ISSMO Symp. on Multidisciplinary Analysis and Optimization, St. Louis, MO, 1998.
- "Traffic Prediction and Management via RBF Neural Nets and Semantic Control" (with Amin et al.), Computer Aided Civil and Infrastructure Engineering 13, pp.315-327, 1998.
- "Survey of Facial Results for the Traveling Salesman Polytope" (with K. Ruland), Mathematical and Computer Modelling Volume 27, Issue 8, pages 11-27, 1998
- "Application of Dynamic Neural Networks to Approximation and Control of Nonlinear Systems," (with Amin et al), Proc. of 1997 Automatic Control Conference, pp. 222-226, Albuquerque, NM, June 4-6, 1997
- "The Pickup and Delivery Problem: Faces and Branch-and-Cut Algorithm" (with K. Ruland), Computers and Mathematics with Applications, Volume 33, Issue 12, pages 1-13, 1997
- Operations Research in Intelligent Transportation Systems - A Semantic Control Approach" (with Garcia et al.) accepted for publication in the International Transactions on OR Journal, to appear in 2000

6. INTERACTIONS/TRANSITIONS

Joint development with HQ/AMC at Scott AFB.